

CLAIMS

1. A process for the treatment of organic waste comprising digesting said organic waste under anaerobic conditions so as to convert at least a portion of said organic waste and produce a clear decant and a mixture of biomass and unconverted organic compounds, returning at least a first portion of said mixture of biomass and unconverted organic compounds to said digesting step so as to control the system net growth rate therein, partially oxidizing at least a second portion of said mixture of biomass and unconverted organic compounds to produce a conditioned effluent therein, and returning said conditioned effluent to said digesting step.

2. The process of claim 1 including digesting said at least a second portion of said mixture of biomass and unconverted organic compounds under anaerobic conditions to produce gaseous carbon compounds, a second clear decant and a second mixture of biomass and converted organic compounds, and feeding said second mixture of biomass and unconverted organic compounds to said partially oxidizing step.

3. The process of claim 2 including separating said second clear decant from said second mixture of biomass and unconverted organic compounds.

4. The process of claim 3 including monitoring the ORP of said conditioned effluent and adding oxidant to said partially oxidizing step to maintain said ORP at a predetermined level.

5. The process of claim 1 wherein said partially oxidizing step comprises electrolysis.

6. The process of claim 1 including conducting electrolysis of an aqueous stream so as to produce an oxidizing agent, and utilizing said oxidizing agent for said partially oxidizing step.

7. The process of claim 6 wherein said aqueous stream includes an acid.

8. The process of claim 6 wherein said aqueous stream includes a salt.

9. The process of claim 8 wherein said salt comprises sodium chloride.

10. A process for the treatment of organic waste comprising contacting said organic waste with anaerobic acidogenic microorganisms so as to convert at least a portion of said organic waste and produce an acidic effluent comprising biomass, acidic organic compounds and unconverted organic compounds, contacting said acidic effluent with anaerobic methanogenic microorganisms so as to convert at least a portion of said acidic effluent to gaseous carbon compounds and produce a clear decant and a mixture of biomass and unconverted organic compounds, subjecting at least a portion of said mixture of biomass and unconverted organic compounds to electrolysis to produce a conditioned effluent therein, and recycling said conditioned effluent to said contacting of said organic waste with said anaerobic acidogenic microorganisms.

11. The process of claim 10 comprising generating molecular hydrogen during said electrolysis and introducing said molecular hydrogen during said contacting of said acidic effluent with said anaerobic methanogenic microorganisms to facilitate conversion of said acidic effluent to methane.

12. The process according to claim 10 integrated with a fermentation process, said fermentation process comprising fermenting a feed comprising plant matter to produce a fermented feed and separating said fermented feed into a product stream, a waste fermentation effluent and waste solids, said waste fermentation effluent comprising organic waste material, said process including subjecting said waste solids to electrolysis so as to produce conditioned waste solids, and contacting said conditioned waste solids with said anaerobic acidogenic microorganisms.

13. The process according to claim 12 wherein said electrolysis comprises a first electrolysis step, said process including subjecting said feed comprising plant matter to a second electrolysis step before fermenting said feed, thereby

generating hydrogen, and introducing said hydrogen to said contacting of said acidic effluent with said anaerobic methanogenic microorganisms in order to facilitate conversion of said acidic effluent to methane.

14. The process according to claim 10 wherein said contacting of said organic waste with said anaerobic acidogenic microorganisms is carried out at a temperature of from about 30 to 70°C.

15. The process of claim 10 wherein said contacting of said organic waste with said anaerobic acidogenic microorganisms is carried out at a hydraulic retention time of from about 1 to 24 hours.

16. The process of claim 10 wherein said contacting of said organic waste with said anaerobic acidogenic microorganisms is carried out at a solid retention time of from about 1 to 72 hours.

17. The process of claim 10 wherein said contacting of said acidic effluent with said anaerobic methanogenic microorganisms is carried out at a temperature of from about 30 to 70°C.

18. The process of claim 10 wherein said contacting of said acidic effluent with said anaerobic methanogenic microorganisms is carried out at a hydraulic retention time of from about 1 to 100 days.

19. The process of claim 10 wherein said contacting of said acidic effluent with said anaerobic methanogenic microorganisms is carried out at a solid retention time of from about 1 to 1,000 days.

20. The process of claim 10 including separating said clear decant from said mixture of biomass and unconverted organic compounds.

21. The process of claim 20 wherein said separating is carried out using a gravity settling tank.

22. The process of claim 10 including subjecting at least another portion of said mixture of said biomass and said

unconverted organic compounds to contact with said acidic effluent.

23. The process of claim 10 including reducing the particle size of said at least a portion of said mixture of said biomass and unconverted organic compounds.

24. The process of claim 10 including monitoring the ORP of said conditioned effluent and adding oxidant to said electrolysis step to maintain said ORP at a predetermined level.

25. The process of claim 1 including separating said clear decant from said mixture of biomass and unconverted organic compounds.

26. The process of claim 25 wherein said separating of said clear decant from said mixture of biomass and unconverted compounds is carried out by means of a gravity settling tank.

27. A process for the treatment of organic waste comprising contacting said organic waste with anaerobic acidogenic microorganisms so as to convert at least a portion of said organic waste and produce a first clear decant comprising organic acids and a first mixture of biomass and unconverted organic material therein, returning at least a portion of said first mixture of biomass and unconverted organic material to said contacting of said organic waste with said anaerobic acidogenic microorganisms, contacting said first clear decant with anaerobic methanogenic microorganisms so as to convert at least a portion of said organic acids to gaseous carbon compounds and produce a second clear decant and a second mixture of biomass and unconverted organic compounds, returning at least a portion of said second mixture of biomass and unconverted organic material to said contacting of said first clear decant with said anaerobic methanogenic microorganisms, subjecting at least a portion of said first mixture of biomass and unconverted organic material and a portion of said second mixture of biomass and unconverted organic material to electrolysis to produce a conditioned

effluent therein, and returning said conditioned effluent to contact said anaerobic acidogenic microorganisms so, as to control the system net growth rate thereof.

28. The process of claim 27 including separating at least a portion of said first clear decant by means of a membrane system to allow organic acids having molecular weights below a desired molecular weight to pass therethrough in preference to organic acids having molecular weights above said desired molecular weight, and passing said organic acids passing through said membrane system to contacting with said anaerobic methanogenic microorganisms.

29. A process for the treatment of organic waste comprising digesting said organic waste in the presence of microorganisms so as to convert at least a portion of said organic waste and produce a clear decant and a mixture of biomass and unconverted organic compounds, producing an oxidizing agent by subjecting an aqueous feed stream containing an oxidizing agent precursor to electrolysis so as to produce a stream of oxidizing agent, partially oxidizing at least a portion of said mixture of biomass and unconverted organic compounds with said stream of oxidizing agent to produce a conditioned effluent therein, and returning said conditioned effluent to said digesting step.

30. The process of claim 29 including returning at least a first portion of said mixture of biomass and unconverted organic compounds to said digestion step so as to control the system net growth rate therein, wherein said at least a portion of said mixture of biomass and unconverted organic compounds comprises a second portion of said mixture of biomass and unconverted organic compounds.

31. The process of claim 29 wherein said digesting of said organic waste is carried out under aerobic or anaerobic conditions.

32. The process of claim 29 wherein said oxidizing agent precursor comprises an acid.

33. The process of claim 32 wherein said acid is selected from the group consisting of hydrochloric acid, nitric acid, sulfuric acid, and mixtures thereof.

34. The process of claim 29 wherein said stream of oxidizing agent has an ORP of between about +300 mv and +1400 mv.

35. The process of claim 34 wherein said stream of oxidizing agent has a pH of between about 0 and 14.

36. The process of claim 34 wherein said stream of oxidizing agent has a pH of between about 0 and 14.

37. The process of claim 29 wherein said stream of oxidizing agent comprises a first stream from said electrolysis step and including producing a second neutralizing stream from said electrolysis step.

38. The process of claim 37 wherein said second neutralizing stream has an ORP of between about -300 mv and -800 mv.

39. The process of claim 38 wherein said second neutralizing stream has a pH of between about 1 and 14.

40. The process of claim 38 wherein said neutralizing stream has a pH of between about 1 and 14.

41. The process of claim 38 including adding said second neutralizing stream to said conditioned effluent.

42. A process for the treatment of organic waste comprising digesting said organic waste under anaerobic conditions so as to convert at least a portion of said organic waste and produce a clear decant and a mixture of biomass and unconverted organic compounds, returning at least a first portion of said mixture of biomass and unconverted organic compounds to said digesting step so as to control the system net growth rate therein, producing an oxidizing agent by electrolysis of an aqueous feed stream, partially oxidizing at least a second portion of said mixture of biomass and unconverted organic compounds with said oxidizing agent to produce a conditioned effluent therein, and returning said conditioned effluent to said digesting step.

43. The process of claim 42 wherein said feed stream comprises an acid.

44. The process of claim 43 wherein said acid is selected from the group consisting of nitric acid, hydrochloric acid, sulfuric acid and mixtures thereof.

45. The process of claim 42 wherein said oxidizing agent has an ORP of between about +300 mv and +1400 mv.

46. The process of claim 45 wherein said oxidizing agent has a pH of between about 0 and 14.

47. The process of claim 45 wherein said oxidizing agent has a pH of between about 1 and 14.

48. The process of claim 42 including providing a neutralizing stream from said electrolysis.

49. The process of claim 48 wherein said neutralizing stream has an ORP of between about -300 mv and -800 mv.

50. The process of claim 49 wherein said neutralizing stream has a pH of between about 1 and 14.

51. The process of claim 48 wherein said neutralizing stream has a pH of between about 1 and 14.

52. The process of claim 48 including returning said neutralizing stream to said conditioned effluent.

53. The process of claim 42 including digesting said at least a second portion of said mixture of biomass and unconverted organic compounds under anaerobic conditions to produce gaseous carbon compounds, a second clear decant and a second mixture of biomass and unconverted organic compounds, and feeding said second mixture of biomass and unconverted organic compounds to said partially oxidizing step.

54. The process of claim 53 including separating said second clear decant from said second mixture of biomass and unconverted organic compounds.

55. The process of claim 54 including monitoring the ORP of said conditioned effluent and adding oxidant to said partially oxidizing step to maintain said ORP at a predetermined level.